GROUNDWATER MANAGEMENT FRAMEWORK
TASK B - DRAFT

Task B includes the identification of technical information needed "to evaluate the current status within groundwater management areas and the potential impact of identified management options." It is assumed that "current status" includes groundwater levels, streamflow and water quality anywhere impacted (even outside of the Groundwater Management Area [GMA]) by development occurring within the GMA. Central Brown County and Southeast Wisconsin are designated GMAs by Act 310. GMAs are defined by a 150-foot drawdown calculated by subtracting simulated predevelopment groundwater levels from simulated current groundwater levels and are not entire groundwater systems or basins in that the important sources of groundwater (recharge areas) are outside of the GMA areas.

Groundwater systems and basins are defined by grouping rock types into aquifers and confining units and determining hydrologic boundaries (e.g., major rivers, groundwater divides or a no-flow boundary as defined by the extent of an aquifer). The amount of groundwater recharge determines the amount of water in a groundwater basin but does not determine the amount that can be withdrawn without serious adverse affects to groundwater levels, water quality and baseflow to streams, wetlands and springs. Any development (pumping) in a groundwater system will create drawdown, a reduction in baseflow, and may induce poor quality water to flow to a well.

To accomplish the part of Task B pertaining to water quantity the following are required: 1) definition of the groundwater/surface water system (including a water budget), 2) a compilation of historic and current water use 3) measurements of historic and current groundwater levels and surface water flows and, 4) construction of a calibrated groundwater flow model. Because of the hydrologic complexity of the GMAs and their associated basins, groundwater flow models are necessary to integrate data into a coherent database that can simulate the effects of development on the groundwater/surface water system. In order to be useful as management tools all models need to be calibrated to field measurements (groundwater levels and streamflow).

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(i) Current status within groundwater management areas (including analysis of cumulative impact of withdrawals) The following is a general list of tasks, data needs and example methods that is intended to give the reader an idea of the scope of study required to accomplish Task B part (i)

TASK	DATA NEEDED	EXAMPLE METHODS
Definition of hydrologic boundaries	Location and extent of geologic units; Location of groundwater divides	Geologic mapping and logging; Groundwater level and streamflow measurements
Measurement of the hydraulic properties of geologic units	Hydraulic conductivity of geologic units and zones within geologic units; Storage properties of geologic units	Displacement/recovery tests
Definition of hydrostratagraphic units (i.e., aquifers and confining units)	Hydraulic properties; Thickness and extent of geologic units	Geologic mapping and logging; Conceptual model development; screening model construction
Water Budget	Baseflow, runoff, precipitation and evaptranspiration rates; Recharge estimates	Stream gaging and climate station network analyses
Historic and current water use	Location of wells; pumping rates; construction reports	Review of DNR and Public Service Commission records
Historic and current groundwater levels (used in model calibration)	Adequate groundwater level measurements to delineate cone of depression for several periods (e.g., 10-year increments) and vertical gradients in some cases	Network of observation wells
Historic and current streamflows (used in model calibration)	Adequate stream discharge measurements to calculate baseflow and trends in baseflow	Network of stream gaging stations
Construction of calibrated groundwater flow model	All previous listed data are required for model construction and calibration	MODFLOW (finite-difference method)
Analyses of model results	Model output which may consist of groundwater levels and streamflow	Contour maps of groundwater levels; Plot of reduction of baseflow for selected streams; Delineation of zones of contribution for individual wells
Water quality	Periodic sampling at well head to determine trends or changes; Discrete interval sampling and analyses from geologic units when possible	Compilation/analysis of existing and historic water quality data; Selective formation packer testing

(ii) Potential impact of identified management options. What information is already available, and what information needs to be developed or gathered?

Published groundwater flow models are available for Central Brown County and Southeast Wisconsin (see references listed below). These models have been used many times to simulate groundwater withdrawals and levels in the sandstone aquifer. However, all groundwater flow models need to be updated as new data become available, water use changes (both withdrawal rate and location), other development occurs (e.g., increases in impervious areas), or to take advantage of improved modeling methods. To accurately simulate and forecast the effects of groundwater withdrawals estimates of water use and measurement of groundwater levels and streamflow are required which implies the need for a well established method of collecting and storing water use data and support of observation well and stream gaging networks. Periodic synoptic water-level measurement surveys (e.g., every 5 years) and an increased effort to develop proper water-level and water-quality monitoring networks in and around GWMAs are required to effectively judge the effectiveness of management plans and define existing and new water resource issues. Research related to water quality issues such as arsenic and radium need to be continued so that sound management methods can be applied to the GMAs.

Conlon, T.D., 1998, Hydrogeology and simulation of ground-water flow in the sandstone aquifer, northeastern Wisconsin: U.S. Geological Survey Water-Resources Investigations Report 97-4096, 60 p., 1 pl.

Feinstein, D.T., Hart, D.J., Eaton, T.T., Krohelski, J.T., and Bradbury, K.R., 2004, Simulation of regional groundwater flow in southeastern Wisconsin: Wisconsin Geological and Natural History Survey Open-File Report 2004-01, 134 p.